World Tuberculosis Day

A clearer picture of drug resistant TB

ABOUT TB

#2 Tuberculosis (TB) is the second leading infectious killer after COVID-19, yet it is a preventable, treatable and curable disease.[1]

TB DETERMINANTS

(cases: millions)[1]

Determinant	Cases (millions)
Undernourishment	2.2
HIV Infection	0.86
Alcohol use disorders	0.74
Smoking	0.69
Diabetes	0.37

In 2021[1]

10.6M Incidence

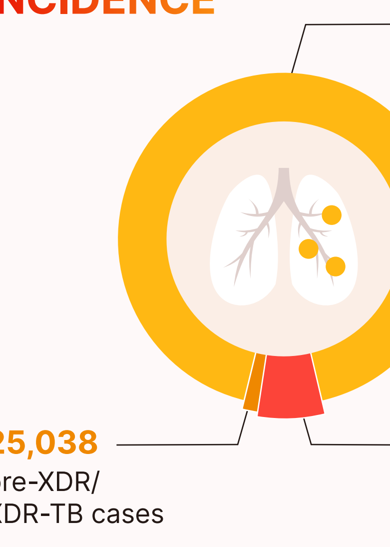
1.6M Mortality

DRUG-RESISTANT TB (DR-TB)

Anti-TB drugs

	Rifampicin	Isoniazid	Fluoroquinolones	Group A drugs
RR-TB (Rifampicin-resistant)[3]	●			
Hr-TB (Isoniazid-resistant)[3,4]		●		
MDR-TB (Multidrug-resistant)[3]	●	●		
pre-XDR-TB (Pre-extensively drug-resistant)[3]	●	●	●	
XDR-TB (Extensively drug-resistant)[3]	●	●	●	●

INCIDENCE



COVID-19-related disruptions to essential TB services contributed to a rise in TB incidence rates and drug-resistant TB burden in 2021, reversing decades of declines[1].

ECONOMIC BURDEN

TB and DR-TB can have significant individual and household financial impact, resulting in lost income and catastrophic costs (costs that account for more than 20% of household income).[1,2]

% of TB cases that experience catastrophic costs:[1]

- All people with TB: 48%
- Drug-susceptible TB: 47%
- Drug-resistant TB: 82%

TREATMENT

161,746 patients started treatment for MDR/RR-TB in 2021[1]

Cost of TB

	TB	MDR-TB	XDR-TB
Average cost per case[5],* including direct treatment costs and productivity losses (2020; USD)	$ 67,000	$ 420,000	$ 801,000
Length of treatment[5] (months)	6-9	20-26	32
Treatment success rate (Global average)	86% new, 2020[6]; 74% relapsed, 2020[7]	60% 2019[8]	60% 2019[9]

*The dollar amount cited in this document is from the CDC's 'The Costly Burden of TB' fact sheet, and represents costs specific to the United States.

DRUG RESISTANCE SURVEILLANCE AND DRUG SUSCEPTIBILITY TESTING (DST)

Routine TB drug resistance surveillance and drug-susceptibility testing (DST) are critical to combat the global TB epidemic and informs TB treatment guidelines.[1,15]

CURRENT DRUG RESISTANCE AND SUSCEPTIBILITY DETECTION METHODS

Targeted next-generation sequencing (tNGS)
<48 hours[10]

Culture-free method that provides a broad resistance profile of first-line drugs (FLD) and second-line drugs (SLD) through deep sequencing of DR-TB gene targets.[10]

Whole Genome Sequencing (WGS)
1-2 days from positive culture[10,11]

Provide complete genome of *M. tuberculosis* (MTB), comprehensive detection of known genes and discovery of novel genes associated with anti-TB drug resistance, and report genetic relatedness between isolates to provide insights for tuberculosis control measures.[10]

Phenotypic – culture-based
4-13 days from positive culture.[12]

Nucleic acid amplification tests
Approximately 2 hours.[13]

Targeted method to detect resistance to some FLD and some SLD.[13]

NGS WORKFLOW

SIMPLE | FAST | ACCURATE

1. Collect Sputum Sample
2. DNA Extraction
3. Prepare Library
4. Sequence
5. Analyze Data
6. Report Results

<48 HOURS
Total Turnaround Time

INSIGHTS OBTAINED THROUGH NGS

- Accurate characterisation of nucleotide-level genetic polymorphisms.[10]
- Detection of mixed infection and heteroresistance down to 3% subpopulations (inaccessible by other rapid molecular tests).[14]
- Detailed sequence information for multiple gene regions or whole genomes.[10]
- Genotyping and spoligotyping of Mycobacterium tuberculosis complex (MTBC) strains.[14]
- Detect resistance to a wide range of first and second-line antituberculosis drugs.[10,14]
- Differential detection of mycobacterial species with clinical relevance.[14,15]

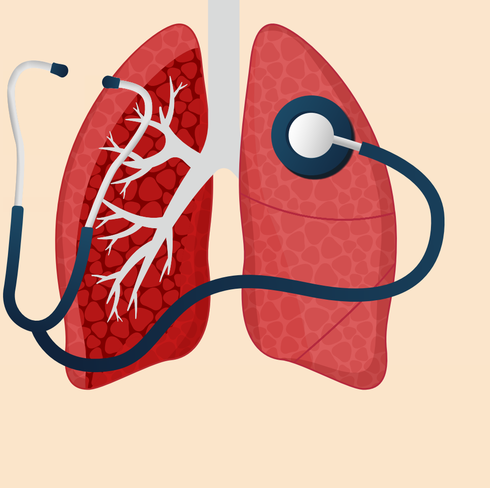
NGS IS A MULTIFUNCTIONAL TOOL

- Revolutionize universal access to rapid, accurate and comprehensive detection of known anti-TB drug resistance.[10]
- Routine TB drug resistance surveillance to detect path of transmission and monitor novel resistance mechanism.[15]

OUTLOOK

4.2 MILLION PEOPLE WITH TB ARE NOT DIAGNOSED OR OFFICIALLY REPORTED

Globally, of the estimated 10.6 million people who fell ill with TB, only 6.4 million were diagnosed and reported. That is a gap of 4.2 million people.[1] Improved drug resistance-detection and surveillance is possible through next-generation sequencing to help address this gap and can bring us closer to the Sustainable Development Goal (SDG) of ending TB by 2030.[10,15]



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